Oases: Architecture and Urbanism in Tropical Desert Regions: From Traditional Wisdom to Contemporary Vision?

Ottmann, Daniela

oases <>

architecture and urbanism in tropical desert regions/ from traditional wisdom to contemporary vision?

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- HISTORY OF A VISION masdar city
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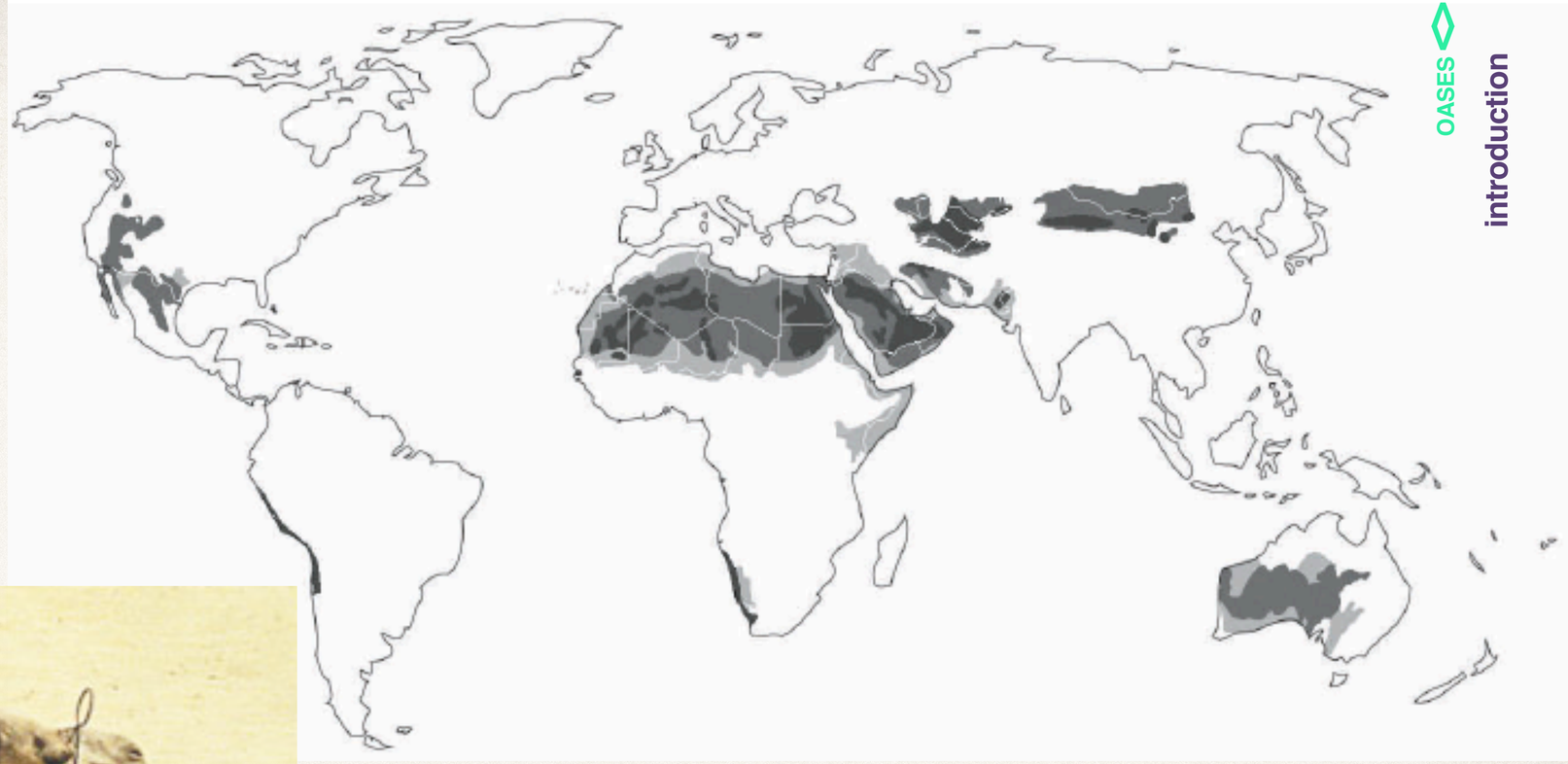
- STATUS QUO vision of masdar compared to the wisdom of the vernacular
- QUO VADIS scenarios discussions
- SPURIOUS SUSTAINABILITY trans-clusion


Masdar City
Abu Dhabi/ UAE
24.43, 54.65
Cfa
Tropic of Cancer
Gold Coast/Australia
-28, 153
Cfa
Tropic of Capricorn

conditioning the desert...

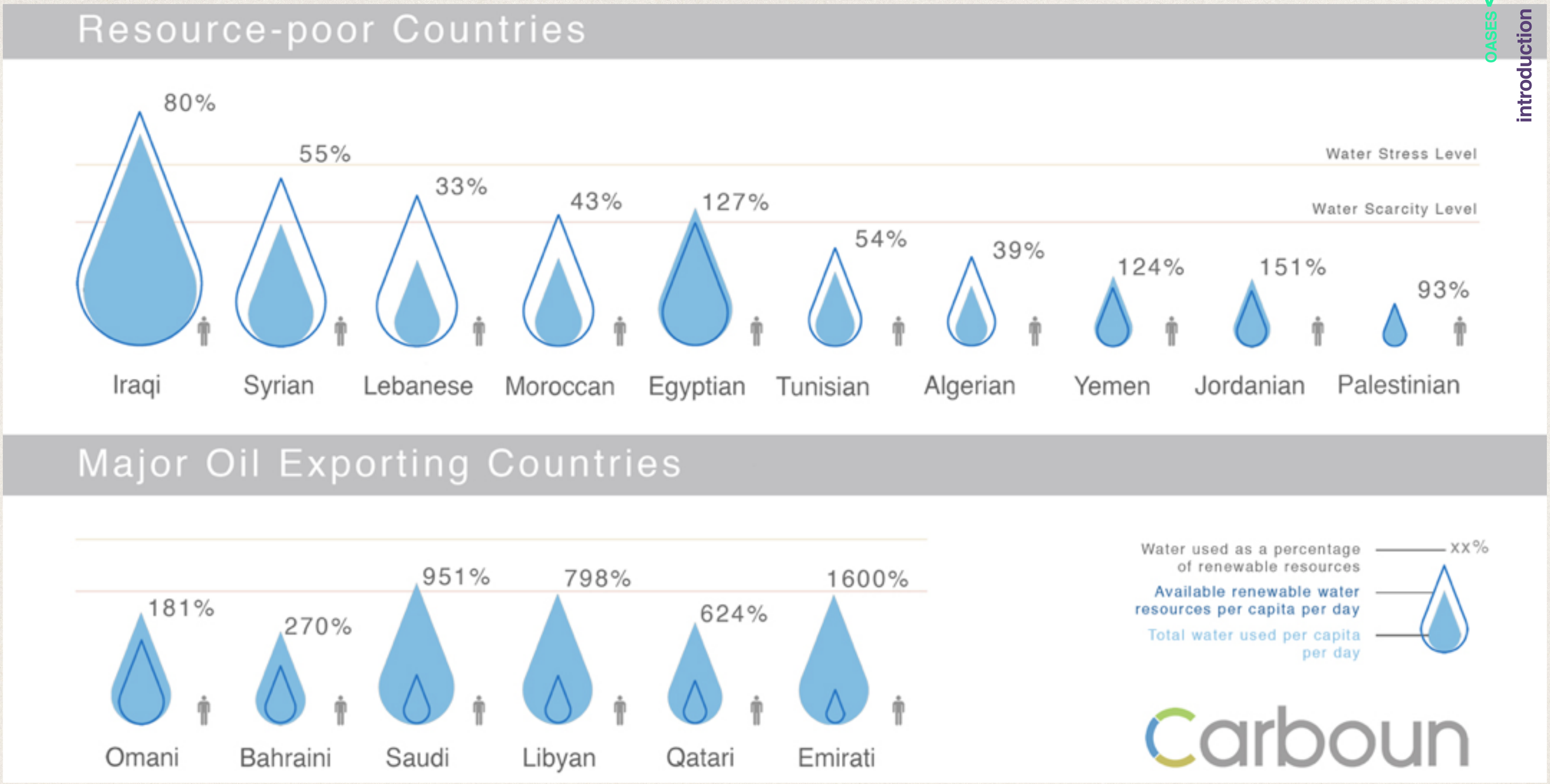


desert climates (Koeppen-Geiger BWh and BWk)

desertification

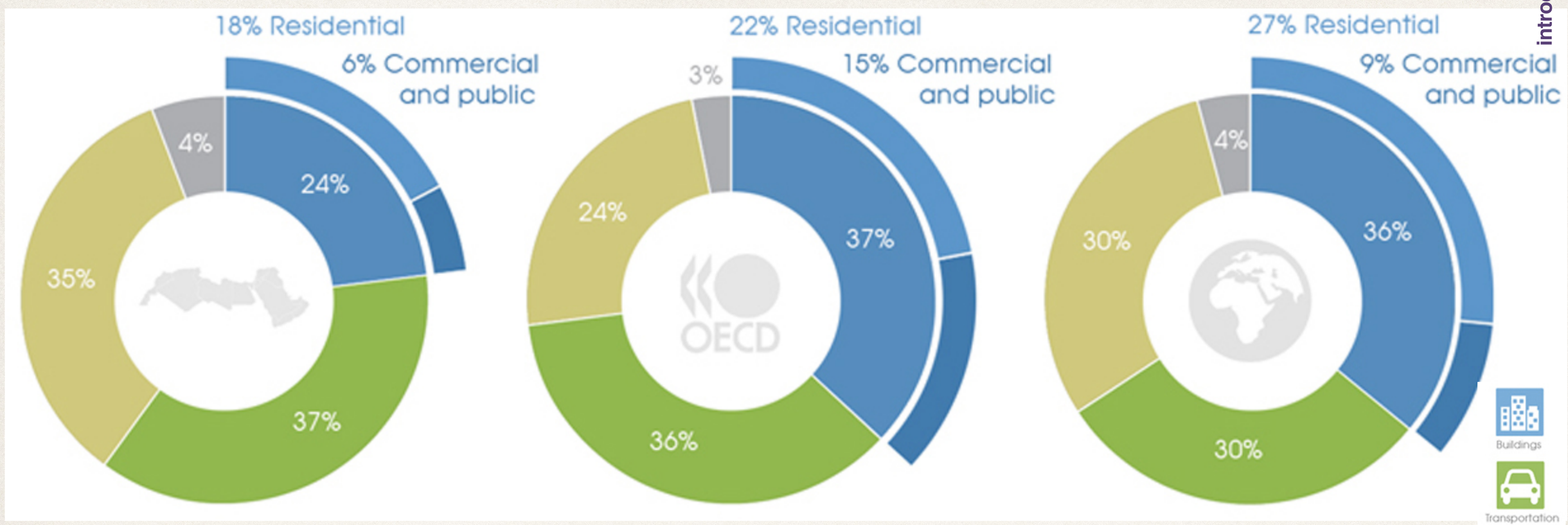
- from wisdom..
- …to vision?

< image courtesy: Google Earth satellite view of Mansafah development



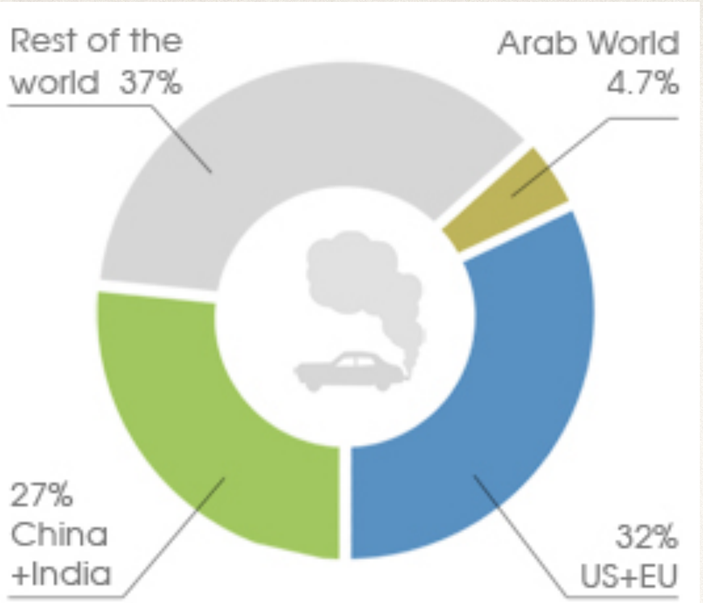
Water Use within Dry Tropics

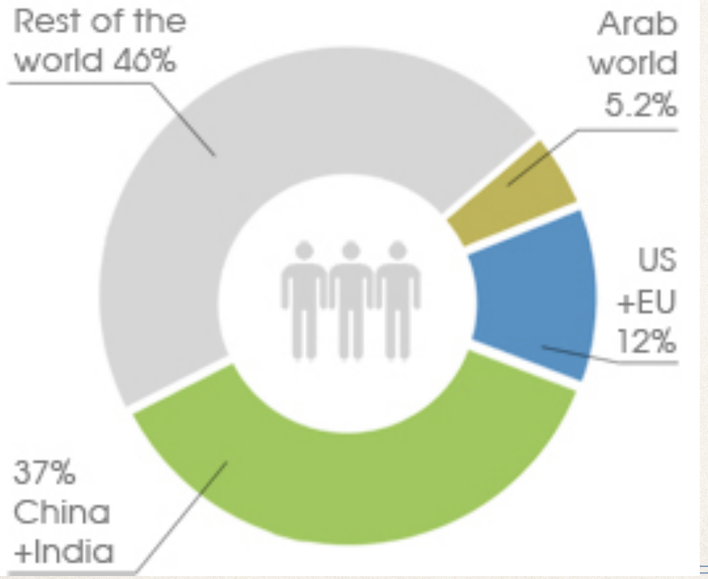
Data Source: IEA and World Bank; Source: www.carboun.com

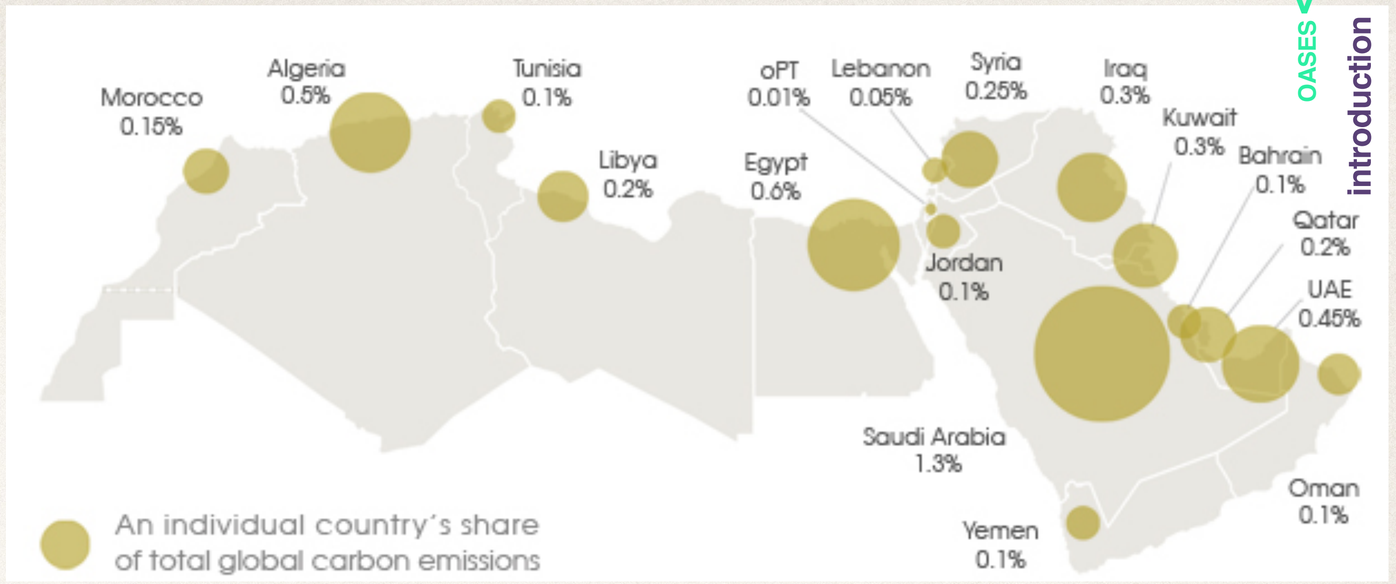


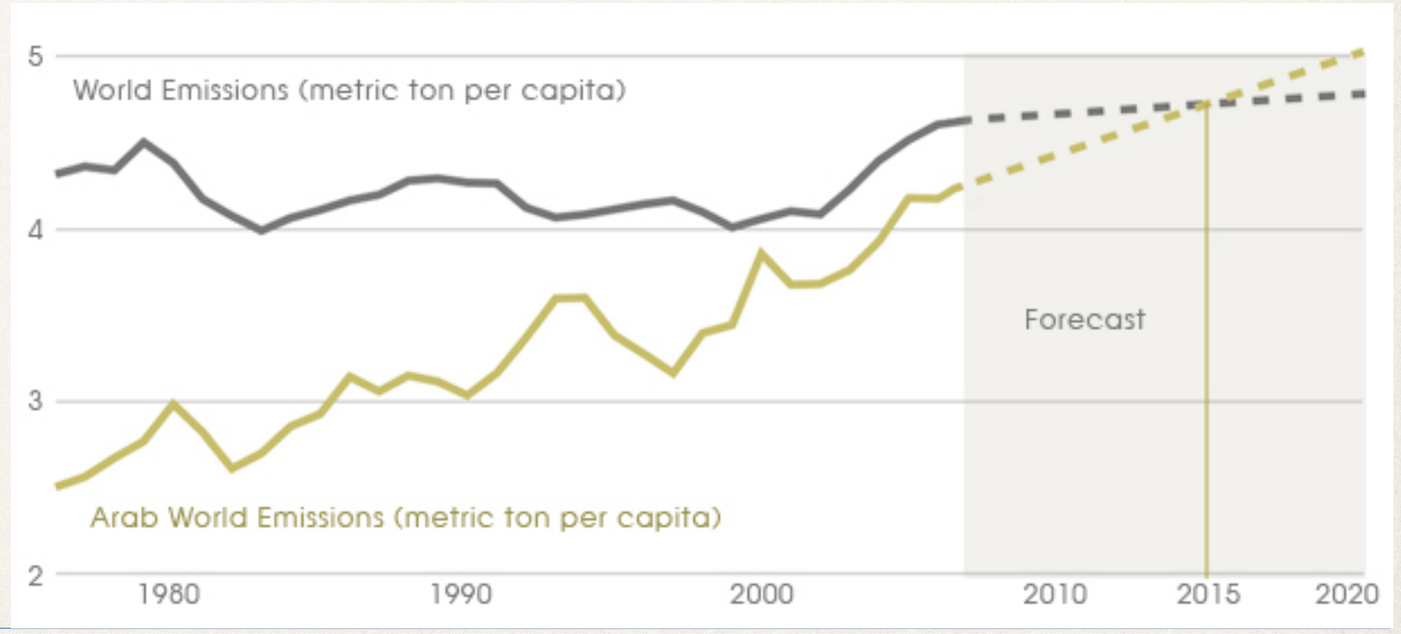
Energy Use in Buildings

Data Source: IEA and World Bank; Source: www.carboun.com







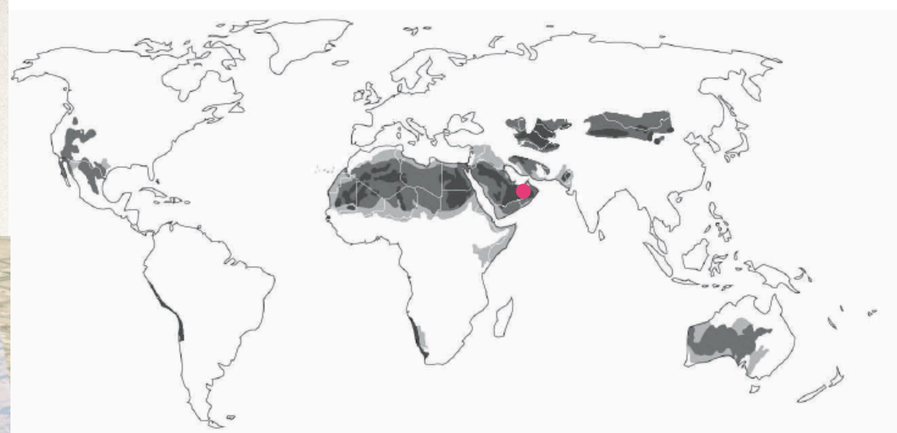


World Carbon Emission in the Arab World

Data Source: IEA and World Bank; Source: www.carboun.com

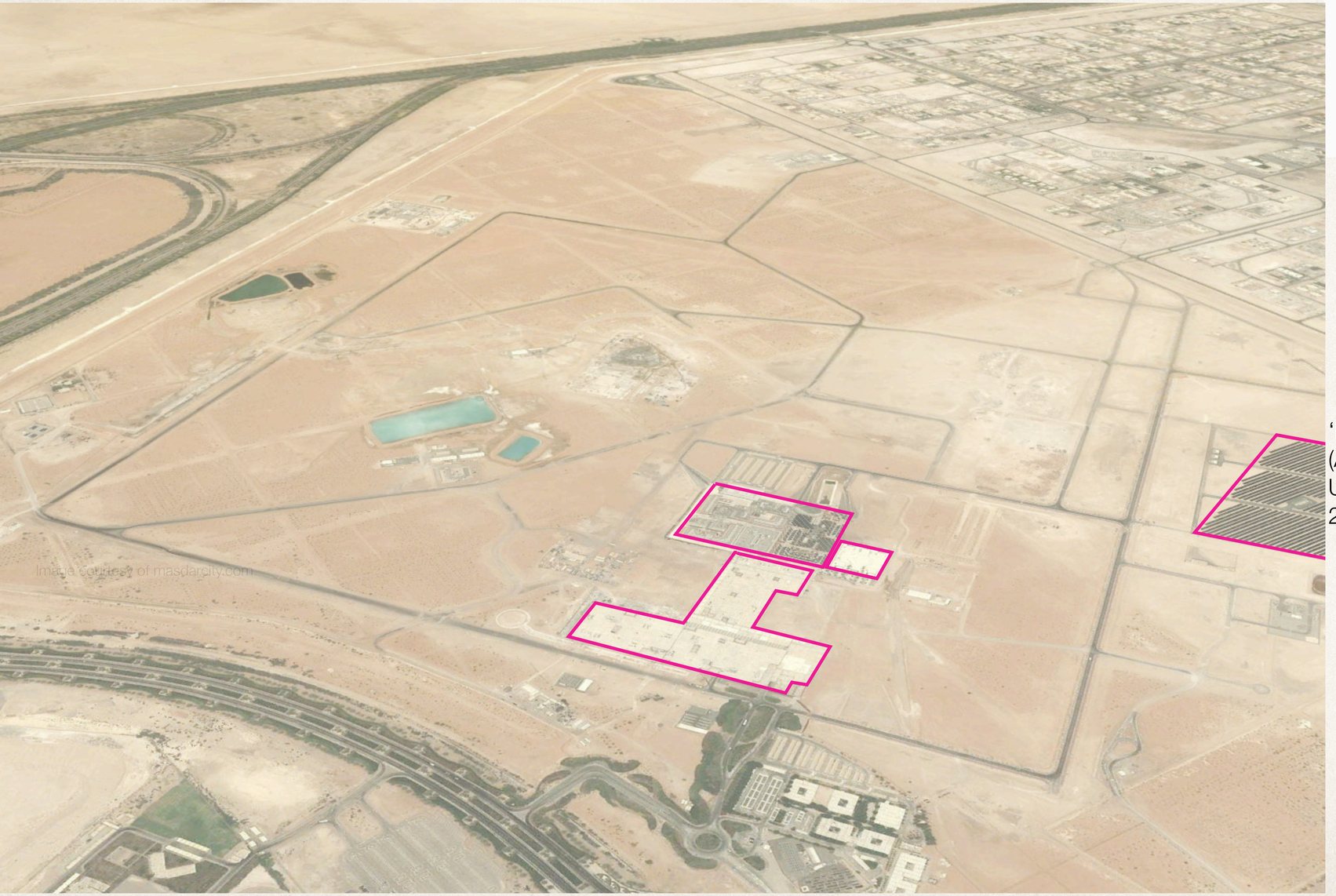
...from "the world's first zero-carbon city"...

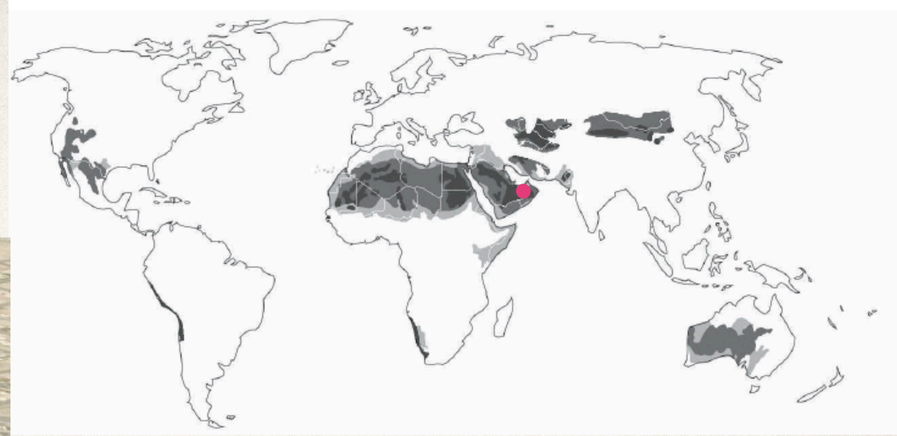
Image courtesy of masdarcity.com



‘Masdar’ City
(Abu Dhabi|UAE)
launched 2006
to be
>zero waste
>zero carbon
>energy self-sufficient by 2020.
> LEED Platinum certification

...to a hub for cleantech firms.





‘Masdar’ City
(Abu Dhabi|
UAE)
2014

history of a vision

2006	Masdar is established with a mission to develop and invest in a commercially viable new-energy sector in Abu Dhabi and around the world. (Mubadala 2019)
2007	Press release “The world’s first zero-carbon, zero-waste city…a new 6 million square meter sustainable development that uses the traditional planning principals of a walled city, together with existing technologies, to achieve a zero carbon and zero waste community by 2020. (Forster 2007)
2011	Masdar Institute of Science & Technology (MIST) Phase 1 opened
2014	Siemens ME HQ opened, designed by Sheppard Robson
2015	IRENA(International Renewable Energy Agency) Headquarters, Emirates Nuclear Energy Corporation, and Nawah Energy Company (Nawah) by architects Woods Bagot (32,000 sq m) 1000sqm PV (Woods Bagot 2018)
2016	Phase 2 and 5 masterplans approved (35% of the planned built-up area by 2021, 30% has been committed to, including private homes, schools, hotels and more office space.) 2,000 homes and a research hub; Phase five is primarily villas and townhouses surrounded by recreational amenities and green open spaces. (Munro 2016)
2017	New CEO appointed for Masdar: ’Today, Masdar City is home to around 300 full-time students of the Masdar Institute of Science and Technology.’(Masdar 2018d)
2018	Etihad Eco Residence completed: 11 buildings, 500 furnished apartments with water heated by solar power panels. (Rousseau 2018)
2019	“Abu Dhabi's Masdar City is one of the world's most sustainable urban communities. It is made up of a rapidly growing clean-tech cluster, business free zone and residential neighbourhood with restaurants, shops and public green spaces.” (Masdar 2019)

MASDAR CITY: WHERE SUSTAINABILITY IS A WAY OF LIFE

RESEARCH, DEVELOPMENT AND PILOT FACILITIES:

27 Masdar Solar Hub: Photovoltaic Test Centre

28 Masdar Solar Hub: CPV Testing Facility

29 Masdar Solar Hub: Masdar Institute Solar Platform

30 Seawater Energy and Agriculture System (SEAS)

31 Electric Energy Storage Solutions Hub

32 Masdar City Eco-Villa Prototype

33 Smart Home Energy Management System (SHEMS)

34 Personal Rapid Transit (PRT) System

35 Masdar City Construction Waste Management

36 Masdar Institute for Science and Technology Field Station

37 Feasibility of District Cooling powered by Geothermal Energy for Masdar City

معهد مصدر للعلوم والتكنولوجيا

- تقييم مدى فعالية غاز التبريد متغير التدفق في ضمان راحة القاطنين في فلل مدينة مصدر الصديقة للبيئة
- تصميم النماذج المناخية المحلية في البيئة الحضرية والتخفيف من حدة آثار ظاهرة "الجزيرة الحرارية الحضرية"
- نمذجة تخزين المياه المبرّدة CWS للتحكم الفعّال بالطاقة داخل المباني في مدينة مصدر
- مركز أبحاث تصميم وتقييم خرائط الطاقة المتجددة
- نظم التبريد المتقدّمة باستخدام المجففات السائلة

MI Masdar Institute

- Assessment of Variable Refrigerant Flow (VRF) for Indoor Comfort Control at Masdar City Eco Villa
- Modelling of Microclimate in the Urban Environment and Mitigation of Heat Island Effect
- Modelling of Chilled Water Storage (CWS) for Effective Energy Control in Buildings
- Research Centre for Renewable Energy Mapping and Assessment (ReCREMA)
- Advanced Cooling by Liquid Desiccant

EXISTING PROJECTS:

1 Masdar Institute of Science and Technology (Phase 1)

2 Masdar Institute of Science and Technology (Phase2)

3 Ryan International School

4 Siemens Middle East HQ

5 International Renewable Energy Agency (IRENA) HQ

6 Incubator Building

7 Khazna Data Centers

8 Masdar 10Mw Solar Photovoltaic Plant

9 District Cooling Plant

10 Masdar Park

11 Residential Complex (500 Units)

UPCOMING PROJECTS:

12 Oasis Residential Complex

13 Residential Building

14 Light Industrial Complex

15 Residential Complex

16 Leonardo Residences

17 Chic Hotel Residence

18 Serviced Apartment

19 Community Mall

20 Masdar Visitor Centre

21 Gems School

22 Emirates College Of Technology

23 Office Building

24 Accelerator Building

25 Office Complex Building

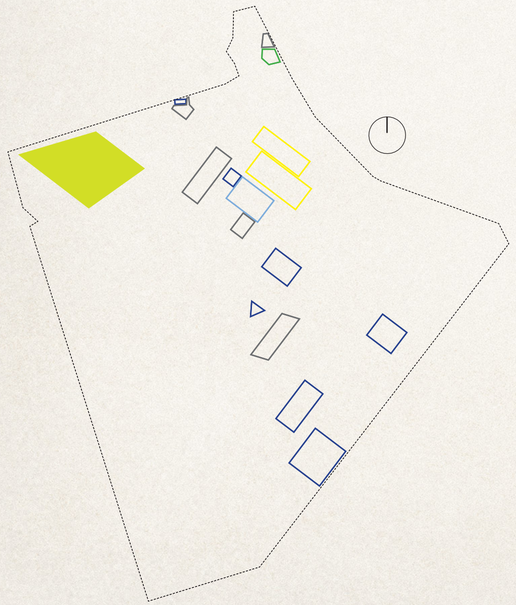
26 Light Industrial Complex

masdar city

- 2019 status quo

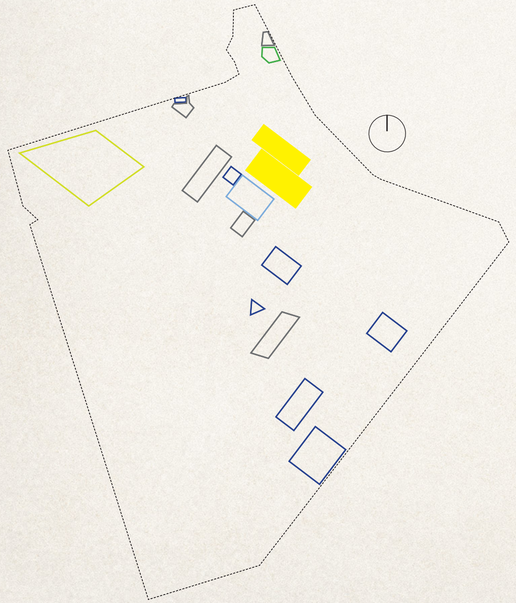
masdar city

- 2019
- PV plant 1.65 ha



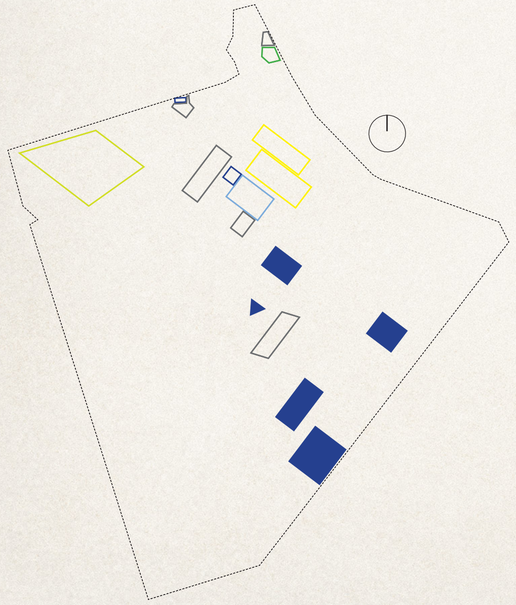
masdar city

- 2019
- Residential



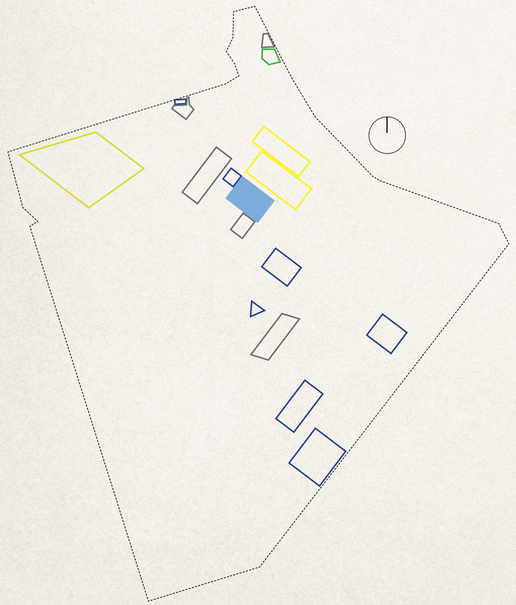
masdar city

- 2019
- Industry/Services



masdar city

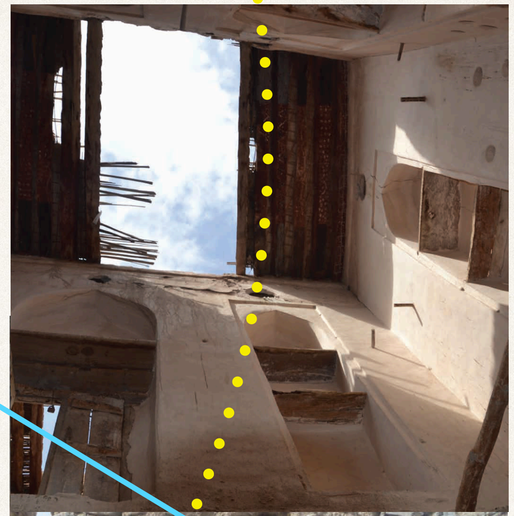
- 2019
- Masdar Institute Phase I




Manama
Bahrain
Qatar
Doha
Dubai
Abu Dhabi
Gulf of Oman
Al Batinah North
Al Hajar Mountains
Muscat
United Arab Emirates
Muscat
Misfah
Eastern
Ad Dhahirah
Ad Dakhiliyah
Ash Sharqiyah North
Ash Sharqiyah South
OASES
traditional wisdom
N
Image Landsat / Copernicus
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
US Dept of State Geographer
© 2018 Google
Google Earth
27°35'07.02" N 49°04'57.47" E elev 0 m eye alt 1099.68 km

Traditional Building Knowledge in Oman.

Oasis as a System



Traditional Building Knowledge in Oman

A research project of Urban Planning and Architectural Design Students from the German Universty of Technology in Oman 2011

Project idea

The students of the 5th semester of the Department of Urban Panning and Architectural Design under the leadership of Asst. Professor Daniela Ottmann, have been researching and compiling on traditional Omani Building constructions throughout Oman.

The mission of this research and analysis is to revitalise knowledge that evolved over thousands of years in Oman in order to transfer this knowledge into the future development of the country accordingly.

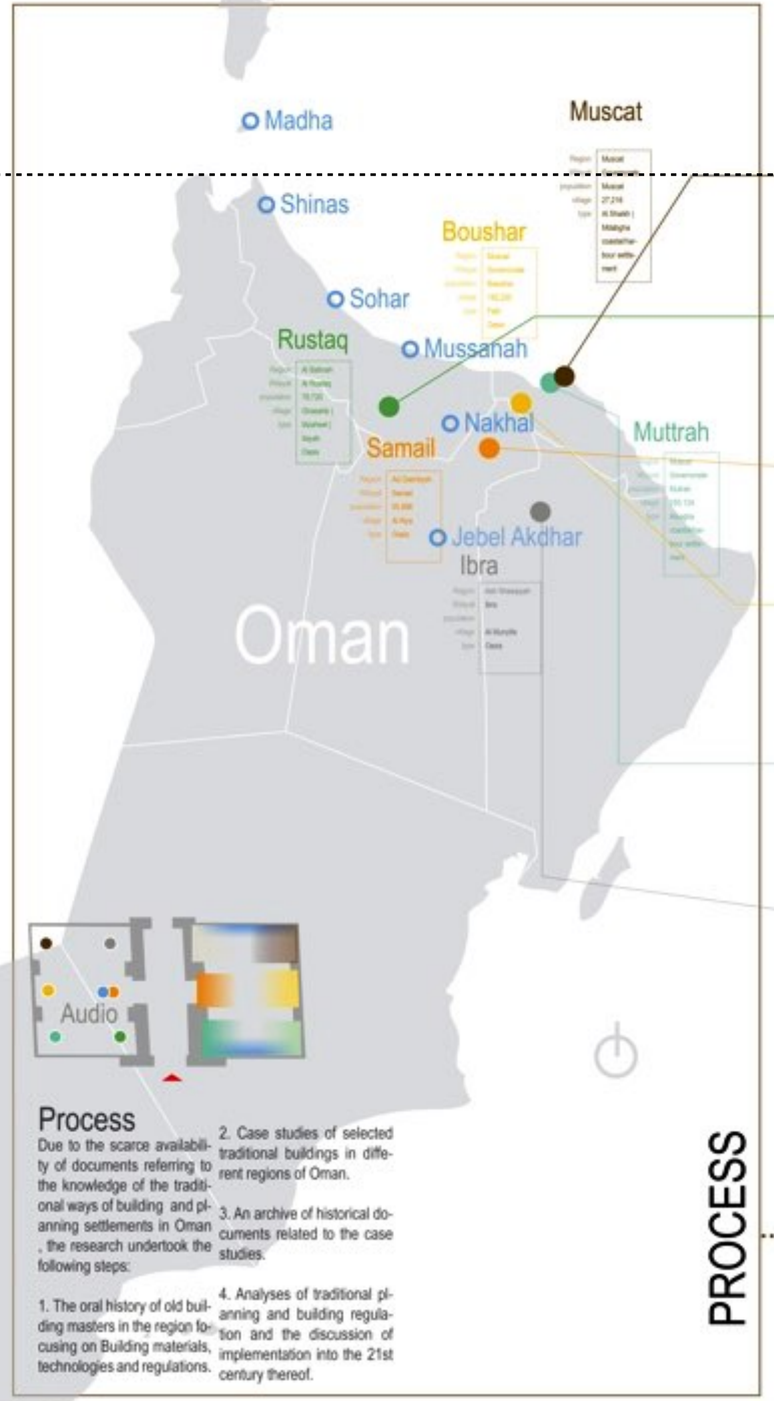
In an exhibition the results of the initial research are presented and in a conference contents are being discussed with the vision to analyse traditional building knowledge further in future scientific work.

Participants:

Urban Planning and Architectural Design students Semester 5 2011:

Alisraa Al Saadi, Amr Al Zadjali, Asia Al Lamki, Asila Al Busaidi, Ayesha Rahman, Fatma Al Rahbi, Fouz Al Busaidi, Haitham Al Rawahi, Hamida Al Riyami, Hanan Al Riyami, Iman Al Ajmi, Khadija Al Mandhari, Mahir Al Arafati, Maysa Al Mandhari, Maryam Al Taei, Mohammed Al Madhani, Nadeen Tall, Nasser Al Sayegh, Nibras Al Molahi, Noor Al Raisi, Ricky Vinayachandra, Rola Al Harthy, Sabreen Al Badai, Sabrina Ahmed, Saleh Al Adawy, Shadha Al Mazrouai, Shaima Al Raisi, Sultan Al Zadjali, Talal Al Haremi, Taleed Rose

with the support of Dipl.-Ing. Yue Chen and under the leadership of Asst.Prof.



Process

Due to the scarce availability of documents referring to the knowledge of the traditional ways of building and planning settlements in Oman , the research undertook the following steps:

1. The oral history of old building masters in the region focusing on Building materials, technologies and regulations.

2. Case studies of selected traditional buildings in different regions of Oman.

3. An archive of historical documents related to the case studies.

4. Analyses of traditional planning and building regulation and the discussion of implementation into the 21st century thereof.

Interviews

Case Studies

Quote :
„The height of our area 'Helat Al Sheekh' is at the same height of Al Miranni fort ."
- Muhsen Hussain Noor Al- Raisi

Quote :
„I prefer loam as it is natural material from sand and we are born from sand , live on sand and die in sand"
- Salim Al Mandhari

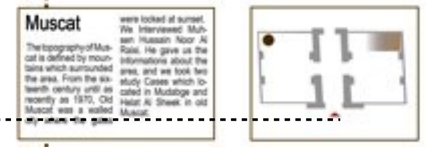
Quote :
" قرين وازع مغطي على سمايل"
-Ghashim bin Said Al- Aghbari

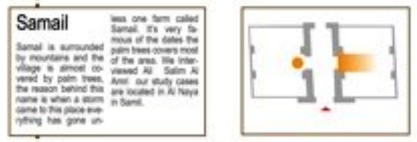
Quote :
„The people of boushar act and work as one community and are always there for each other"
- Al Sayyid Qahtan bin Nassir AL-Busaidi

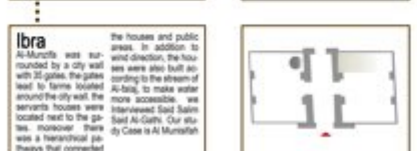
Quote :
„People in the past were satisfied by the little things not because they can't get more but because of their contentedness."
-Siddiq Dawood Ali Al-Sayegh

Quote :
„Arabs preferred to live close to each other"
- Said Salim Said Al-Gathi

Quote :
"الجبل الاخضر واحه امان في حضن عمان"
-- Salim Mohammed Hourmood Al Toobi







PROCESS

[O] ral history
interviews

The research students went to their places of origin and found the last generation of old people who still have the knowledge of the traditional way of building and planning their settlements.
The interview questions covers topics like building regulations, water supply, building materials, climatic design, functions of spaces, etc...

[S] ite Survay

Additionally to the interviews the researchers have conducted surveys of buildings within the area of origin as example case studies to support and deepen the knowledge given through the interviews. The surveyed buildings in 2011 are mostly depleting ruins since hardly any existing and still in use loam buildings could be found

[D] ocument Research

To support the investigation of the case study buildings of the origin places, additional sources of information is gathered through old pictures, paintings, documents, certificates, publications, etc.

EXHIBITION

Traditional Building Knowledge [TBK] exhibition and conference 2011

Tradit
further research and analysis
transfer of knowledge

Manual to Future Building Knowledge [FBK] 2012

OASES

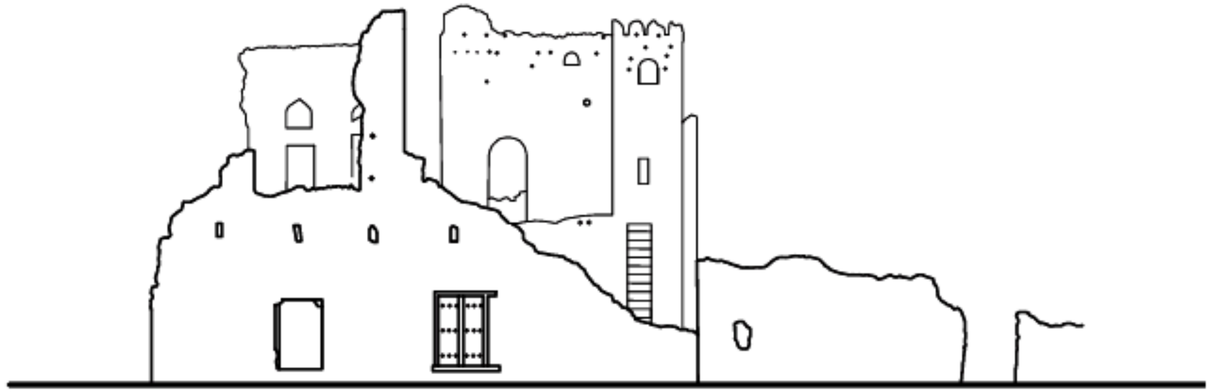
traditional wisdom

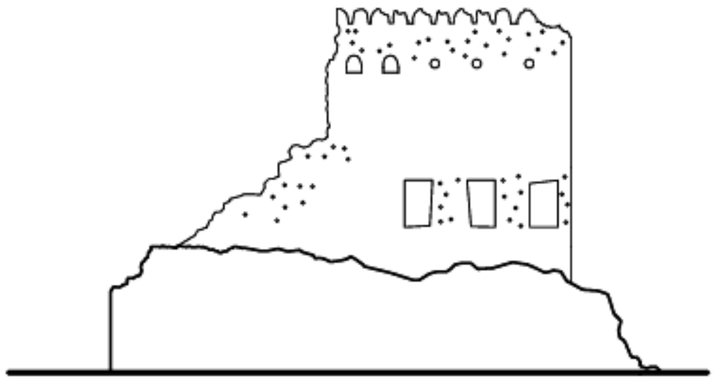
Portrait

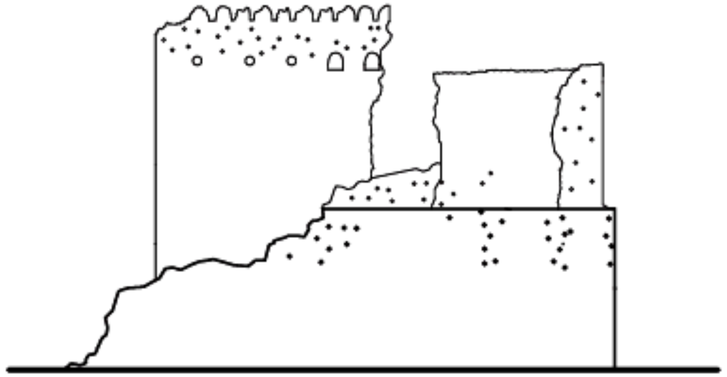
Quote :
„Arabs preferred to live close to each other."
- Said Salim Said Al-Gathi

About

Name	Said Salim Said Al-Gathi
Profession	Sheikh of Al-Mu'taradh
Age	Eighty eight years old
Date of Interview	19th December, 2011
Location	Said Salim's Residence
About:	At the age of 17, travelled to Eastern Africa for business trades and lived there for almost 15 years. Later lived in Ibra and was assigned to be responsible and look after the town and community. Moreover still have the connections with the government, when dealing with community problems and solving conflicts. Education: learned and educated in Ibra, Knowledge was based on Al-Shariaa Al-Quran and grammar and rhetoric.
Interviewer	Rula Al-Harthy







Al Munzifa
Location: Ibra
Elevations
Scale 1 : 100

SITE Analysis

Al-Munzifa is located in Ibra which is 3km away from Al-Mu'taradh.

It is surrounded by many natural elements such as the mountains, the Aflaj and the Wadi's.

The built up area is between 200 – 250 sqm for residential buildings and up to 400 sqm for the sheikh's house and public areas.

Buildings were mostly two to three floors high and mostly had basements.

Most residents were either farmers or sheep herders and the Sheikh was responsible for solving conflicts.

IBRA

STREETS Analysis

There were different types of streets: wider streets connecting the main areas such as the different gates, public areas such as the hospital, the mosque and the souq. These roads barely fit a car as there were no cars back in the day, although they were very suitable for horses and donkeys etc...

The streets were also used as race tracks for horse races "Mirkadh". The races were conducted between the Dirwaz Al Alawiaa which is the eastern gate of Al Munzifa to Dirwaz Al Haidara which is the west gate of Ibra.

IBRA

DECORATION Analysis

Large shelves were found in many rooms and were used to display weapons, perfumes etc...
In addition to many engraved doors and frames which were used as a decoration element.

IBRA

CLIMATE DESIGN Analysis

In addition to the consideration of building materials to keep the inside of the buildings as cool as possible, buildings were mostly oriented towards wind direction to allow better ventilation.

Trees were also used for the shading areas and protecting the city wall.

IBRA

Portrait

Quote :
„The falaj is the center of community, it could either bring the community together or cause clashes between the families.“ - Zahir Mohammed Al-Harasi

About

Interviewee	Zahir Mohammed Al-Harasi
Name	Zahir Mohammed Al-Harasi
Profession	Retired, used to be in-charge of the Falaj system
Age	Eighty three years old
Date of Interview	1st November, 2011
Interviewers	Asia, Hamida and Maiysa

WATER Analysis

People mostly used the Aflaj as a water source where water was distributed based on time, using the sun during the day and the stars during the night.
As Al-Munzifa was known for the abundance of water, most houses had streams running in front of them, in addition to have one or two wells inside their courtyards.

IBRA

MATERIALS Analysis

Stone from local mountains and Wadis

Hay (fiber) from palm trees used to tie building materials together
Local Sidr tree wood used for floor slabs
Local Palm tree wood and fronds was used for floor slabs and roof construction, some wood material were imported from Zanzibar or India.
A mixture of mud and gravel found from local sites.

IBRA

	Masdar City Vision, Masdar 1.0 (anticipated plan 2007)	Masdar City, Masdar 2.0 (status 2019)	Traditional Oasis settlement Misfat al Abriyyin
Area of development:	6 square km = 600ha	9 ha building footprint (1.5% of original vision) other areas U/C	0.5 ha built up surrounded by 2.5ha oasis farmland
	Self-sufficient by 2020	Depended on conventional Abu Dhabi power (mainly oil power), water (desalinated) and waste service. district cooling plant U/C; no farm land, recycling and alternative energy sources for self-suffiency intended.	Self-sufficient oasis pre-industrial time-age; zero carbon and zero waste approach through ecologically cycled network and climate-adapted oasis architecture
	Zero carbon by 2020	1.65 ha PV (2MW), light/ water tap sensors	No emissions
	Car-free	7.8ha on ground parking for access to all buildings by car; Mock-up of a PRT system	Car-free
Population density:	130-160 people/hectare	83 people/hectare (300 students in Masdar Institue Phase 1)	200 people/ha including farmland;
Building heights:	Average height: 4-6 storeys	4-6 storeys	2-3 storeys
Street width:	Central Spine: 25 metres	U/C	Central area max. 7 metres
	Main streets maximum: 14 metres	U/C	Max. 3.5 metres
	Secondary streets: 8.5 metres	Only deliverd at MI(Masdar Institute) Phase 1	Sikkas max. 1.5 meters
	Max. distance of 200m to nearest transport link	No public transport system connected yet	Decentralised settlement
	Shaded walkways and narrow streets; pedestrian friendly	Mixed used environment on MI Phase 1 development only	Shaded walkways and narrow streets; pedestrian friendly
	Self-sustaining surrounding land: wind, pv farms, research fields and plantations	PV farm, District Cooling plan instead of alternative energy research fields; no plantstions	Self-sustaining surrounding land: water, wind, solar capture, crops fields and date plantations

	Masdar City Vision, Masdar 1.0 (anticipated plan 2007)	Masdar City, Masdar 2.0 (status 2019)	Traditional Oasis settlement Misfat al Abriyyin
Urban architecture design principles:	Optimal orientation: southeast-northwest	Base grid remains, but fringes are seamed by industry, the centre has offices and retail	East-west
	Integrated, no separated zones	Separated zoning for residential, community facilities, offices, retail, r+d industrial and hotels.	Integratation of functions with public-private hierarchy ascension
	Low rise, high density	Building typologies of MI Mock-up are discontinued to make space for business-as usual solitaire on the lot seamed with abundant parking around.	Very dense built up clusters
	Vibrant urban realm	Only students live there permanently; other commuters might gather around retail area during working hours. A community park has open 1km away from Masdar Institue	Meandering mace-like alleyways connecting to cetrnal square and fading out into oasis green belt
	Pedestrian friendly	MI Phase 1 yes…but now all new parking lots are indicating the counter principle	Pedestrianised / donkey and camel carriage; cars do not fit into the urban fabric; residential and community areas connect directly to farms
	High quality of life	U/C but will heavily dependent on density and socio-cultural factors of people that might inhabit this development.	Sensitively connected parts of the human, natural and built environments of the oasis; however the socio-economic shift from regional to global trade has changed anthropogenic need of the current society. The traditional oasis system has not survived int the 21st century.

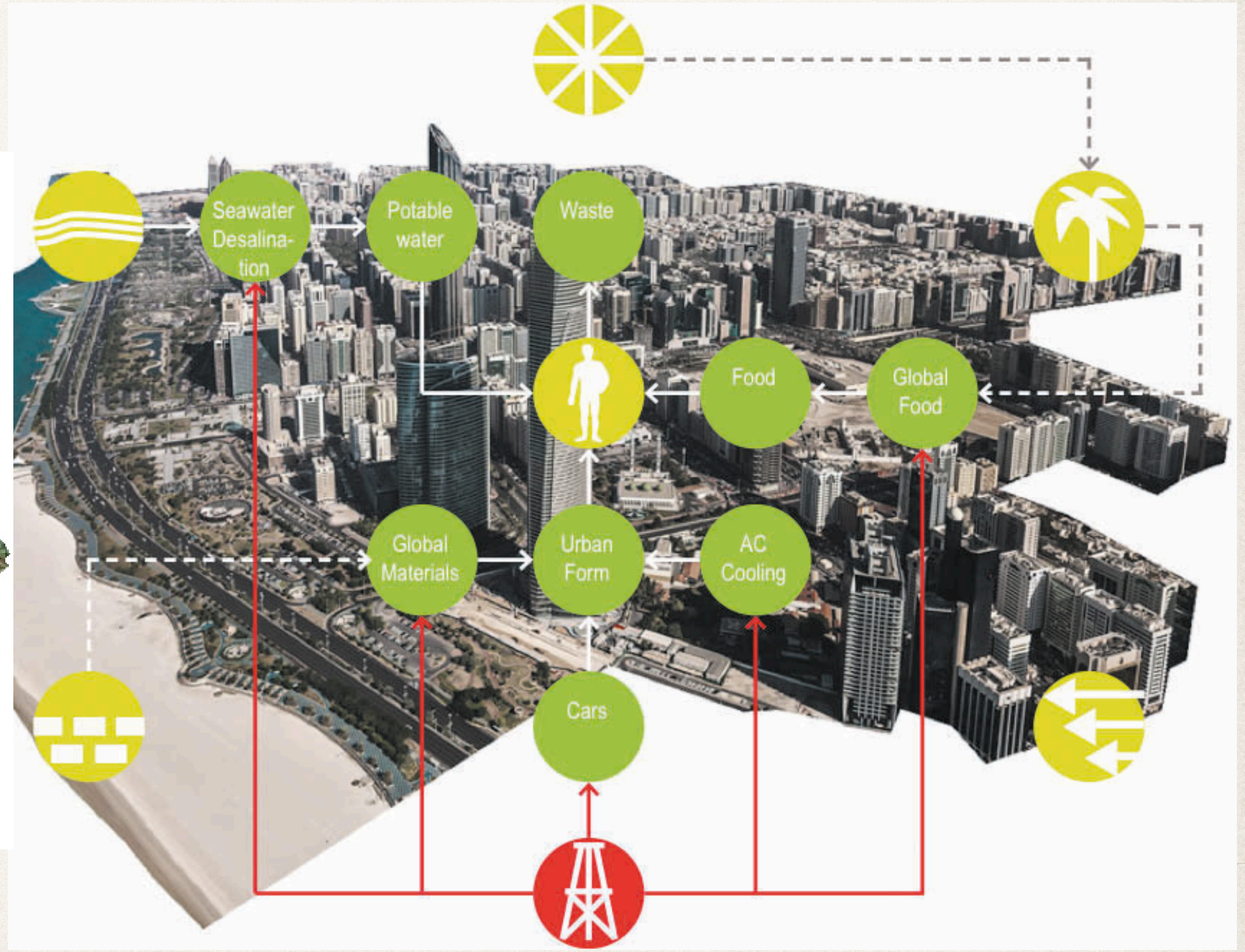
scenario 1

- securing continued economic growth of the 'clean' energy business: from zero waste to infinite radiative nuclear waste?
- Masdar Atomic: a platform for nuclear services and product trade;
- The Emirates Nuclear Energy Corporation (ENEC) headquarter

scenario 2

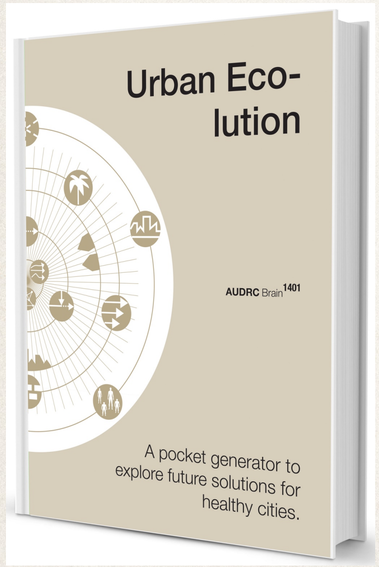
- Integrate higher complexity: Masdar 3.0 as integrated oasis system.

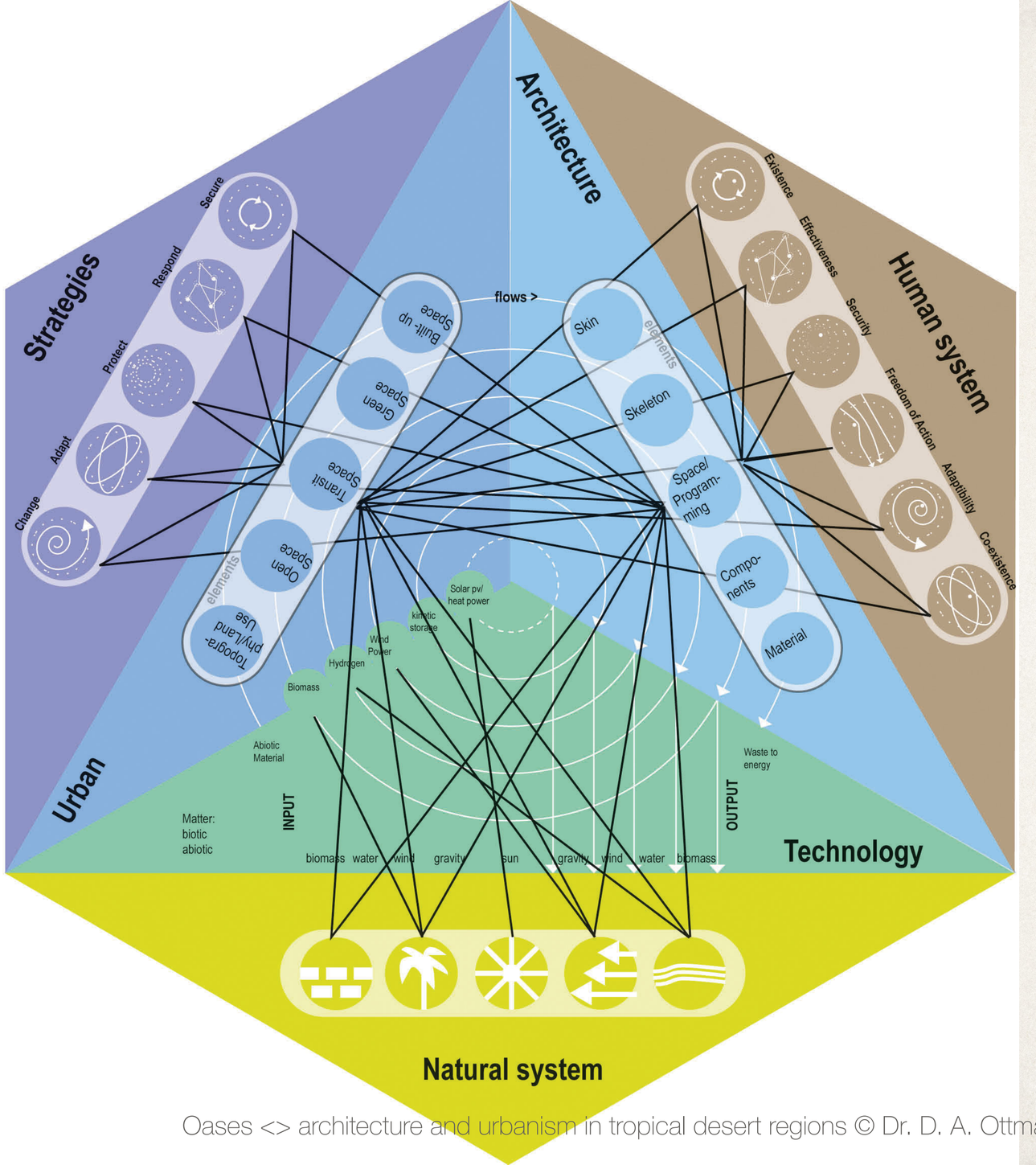
wisdom > < vision



scenario 3

- continued wisdom through eco-innovations:
- from مَصْدَر maṣdar (source) to ميزان mizan (balance)





wisdom <> vision

- ميزان mizan (balance) city

how to combat “Spurious Sustainability” for genuine ecologically sound architecture and urbanism ?

thank you iNTA

please get in touch… dottmann@bond.edu.au

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